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# NGST

## Ariane 5

- **Performance**

- GTO: 6800 kg
- Improvements to achieve 8000 kg to GTO are proposed
- Escape orbit capabilities TBD

- **Fairing/Payload Envelope**

- 5.4 m aluminum/composite fairing
- Envelope maximum cylindrical diameter: 4.57 m
- Envelope overall length: 11.2 m
- Envelope cylindrical section length: 10.35 m

- **Fairing Growth Plans**

- None known

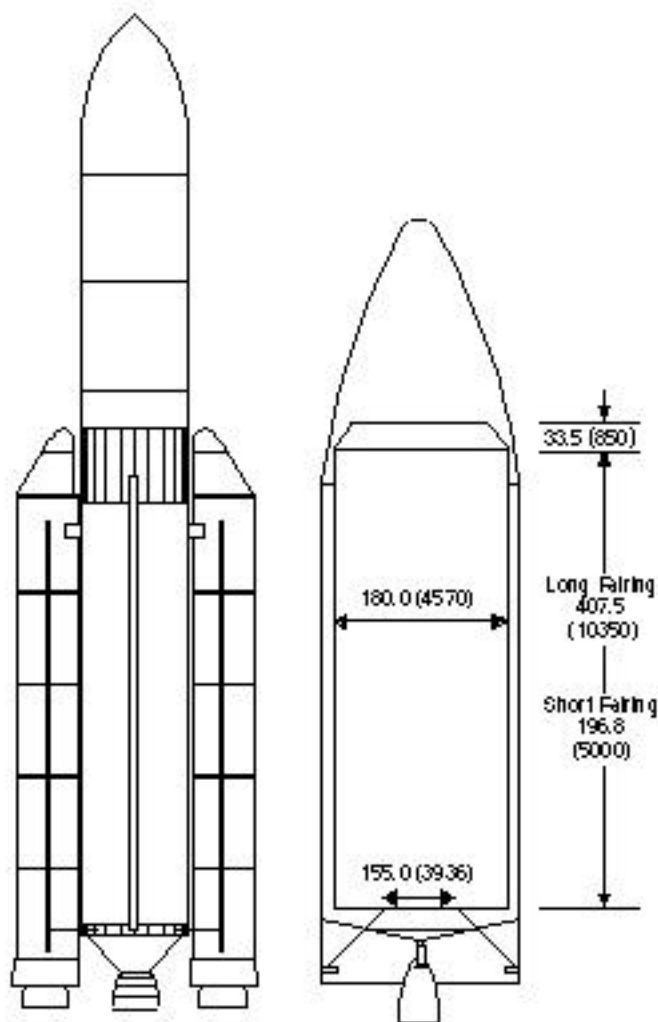
- **Launch Availability**

- ELA: ELA-3
- Upgraded performance version in 2002

- **Basic Launch Service Cost**

- \$120M (AIAA International Reference Guide to Space Launch Systems)

<http://www.arianespace.com/ariane/anglais/aew122.html>



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## Atlas IIAR

### ● Performance

- Escape ( $C3 = 0 \text{ km}^2/\text{sec}^2$ ): 2970 kg
- 1 AU x 3 AU ( $C3 = 45 \text{ km}^2/\text{sec}^2$ ): 1150 kg
- 1 AU x 5 AU ( $C3 = 77 \text{ km}^2/\text{sec}^2$ ): < 450 kg (performance to high C3s can be improved with payload provided kick stage)

### ● Fairing/Payload Envelope

- 4.2 m aluminum fairing
- Envelope maximum cylindrical diameter: 3.65 m
- Envelope overall length: 10.31 m
- Envelope cylindrical section length: 5.01 m, with cut-outs

### ● Fairing Growth Plans

- Local envelope diameter increase may be negotiated within constraints of existing fairing

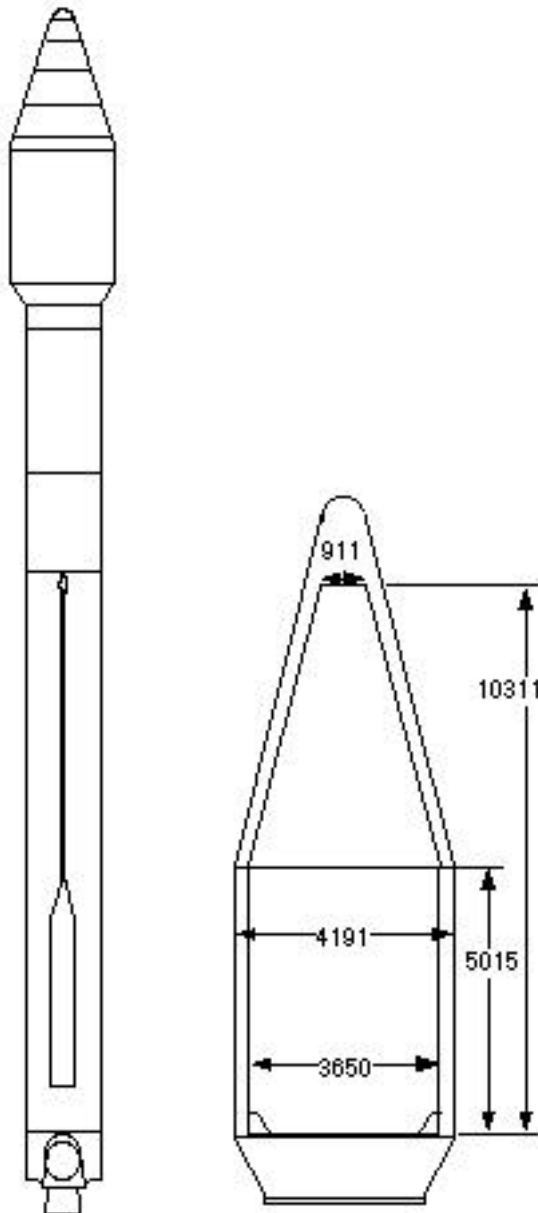
### ● Launch Availability

- CCAFS: LC-36B
- Initial Launch: December 1998
- Would likely be replaced by EELV if Lockheed Martin develops EELV

### ● Basic Launch Service Cost

- \$95-105M for Atlas IIAS (AIAA International Reference Guide to Space Launch Systems)

[http://www.lmco.com/ILS/txtmain/design\\_atlas.htm](http://www.lmco.com/ILS/txtmain/design_atlas.htm)



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## Atlas IIARS

### ● Performance

- Escape ( $C3 = 0 \text{ km}^2/\text{sec}^2$ ): 3170 kg
- 1 AU x 3 AU ( $C3 = 45 \text{ km}^2/\text{sec}^2$ ): 1250 kg
- 1 AU x 5 AU ( $C3 = 77 \text{ km}^2/\text{sec}^2$ ): < 475 kg (performance to high  $C3$ s can be improved with payload provided kick stage)

### ● Fairing/Payload Envelope

- 4.2 m aluminum fairing
- Envelope maximum cylindrical diameter: 3.65 m
- Envelope overall length: 10.31 m
- Envelope cylindrical section length: 5.01 m, with cut-outs

### ● Fairing Growth Plans

- Local envelope diameter increase may be negotiated within constraints of existing fairing

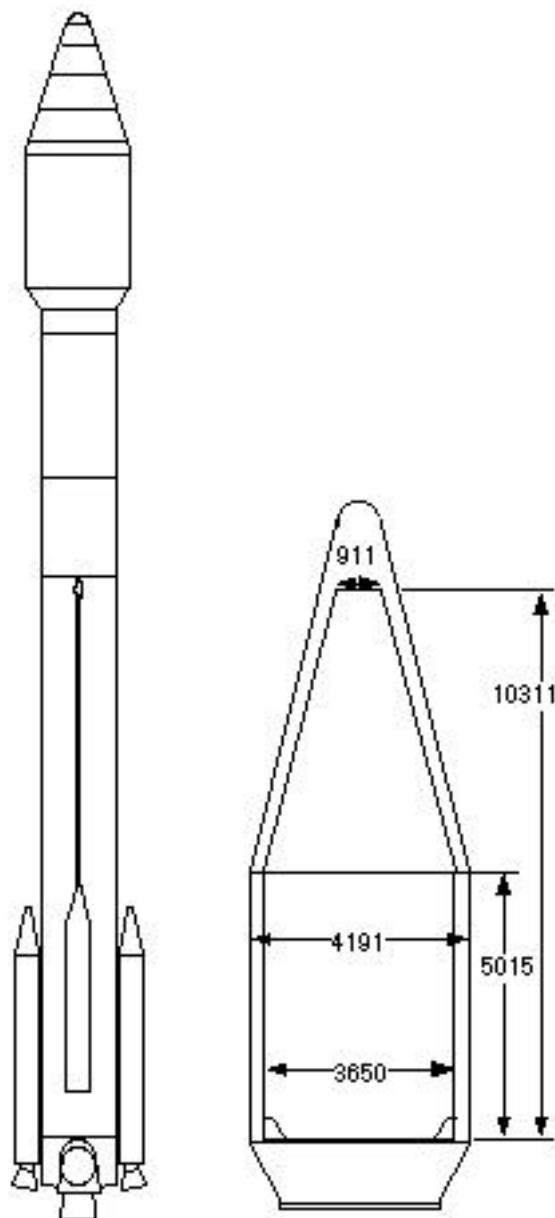
### ● Launch Availability

- No current customers for this Atlas version
- CCAFS: LC-36B
- Initial Launch: December 1998 (IIAR version)
- Would likely be replaced by EELV if Lockheed Martin develops EELV

### ● Basic Launch Service Cost

- \$95-105M for Atlas IIAS (AIAA International Reference Guide to Space Launch Systems)

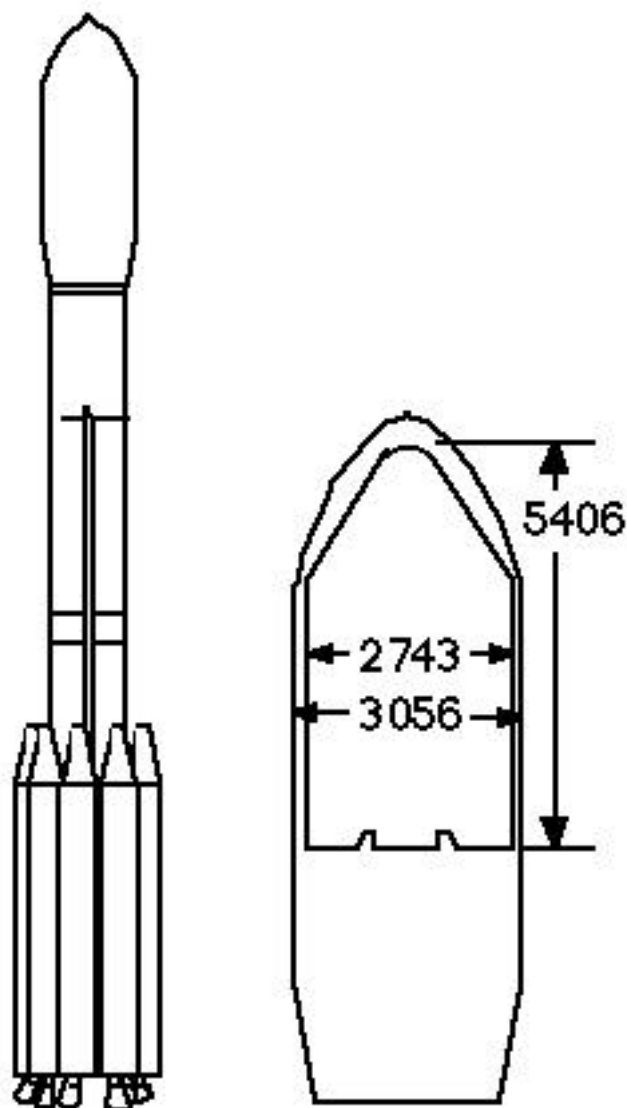
[http://www.lmco.com/ILS/txtmain/design\\_atlas.htm](http://www.lmco.com/ILS/txtmain/design_atlas.htm)



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## Delta II 7925



- **Performance**

- Escape( $C_3 = 0 \text{ km}^2/\text{sec}^2$ ): 1261 kg

- **Fairing/Payload Envelope**

- 3.0 m composite fairing
- Envelope maximum cylindrical diameter: 2.74 m
- Envelope overall length: 5.41 m
- Envelope cylindrical section length: 3.66 m

- **Fairing Growth Plans**

- none

- **Launch Availability**

- CCAFS: LC-17A/B
- VAFB: SLC-2
- Would likely be replaced by EELV if McDonnell Douglas/Boeing develops EELV

- **Basic Launch Service Cost**

- \$45-50M (AIAA International Reference Guide to Space Launch Systems)

<http://www.mdc.com/version2/space/delta2.htm>

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## Delta III (2-stage)

- **Performance**

- Escape ( $C3 = 0 \text{ km}^2/\text{sec}^2$ ): 2700 kg
- 1 AU x 3 AU ( $C3 = 45 \text{ km}^2/\text{sec}^2$ ): <800 kg

- **Fairing/Payload Envelope**

- 4.0 m composite fairing
- Envelope maximum cylindrical diameter: 3.75 m
- Envelope overall length: 8.89 m
- Envelope cylindrical section length: 4.37m

- **Fairing Growth Plans**

- 5 m class fairings may be considered

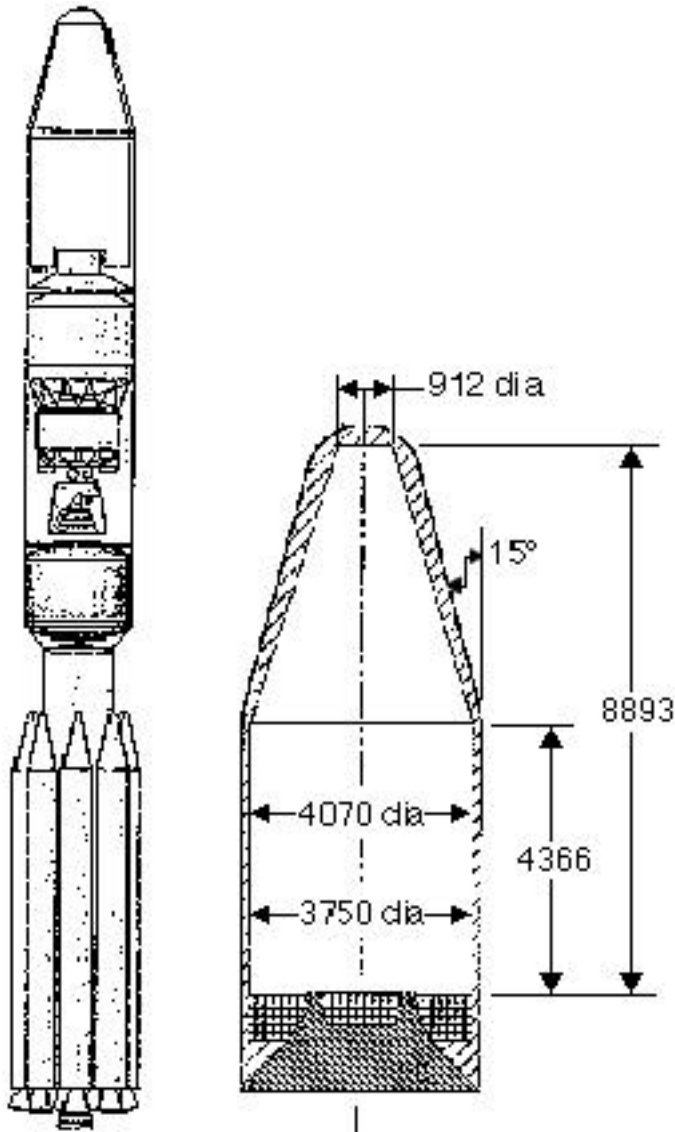
- **Launch Availability**

- CCAFS: LC-17B
- VAFB being considered
- Initial Launch: May 1998
- Would likely be replaced by EELV if McDonnell Douglas/Boeing develops EELV

- **Basic Launch Service Cost**

- TBD

<http://www.mdc.com/version2/space/delta3.htm>



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## Delta III (3-stage)

### • Performance

- Escape ( $C3 = 0 \text{ km}^2/\text{sec}^2$ ): 2700 kg
- 1 AU x 3 AU ( $C3 = 45 \text{ km}^2/\text{sec}^2$ ): 1250 kg
- 1 AU x 5 AU ( $C3 = 77 \text{ km}^2/\text{sec}^2$ ): < 750 kg

### • Fairing/Payload Envelope

- 4.0 m composite fairing
- Envelope maximum cylindrical diameter: 3.75 m
- Envelope overall length: 6.91 m
- Envelope cylindrical section length: 2.39 m

### • Fairing Growth Plans

- 5 m class fairings are being considered

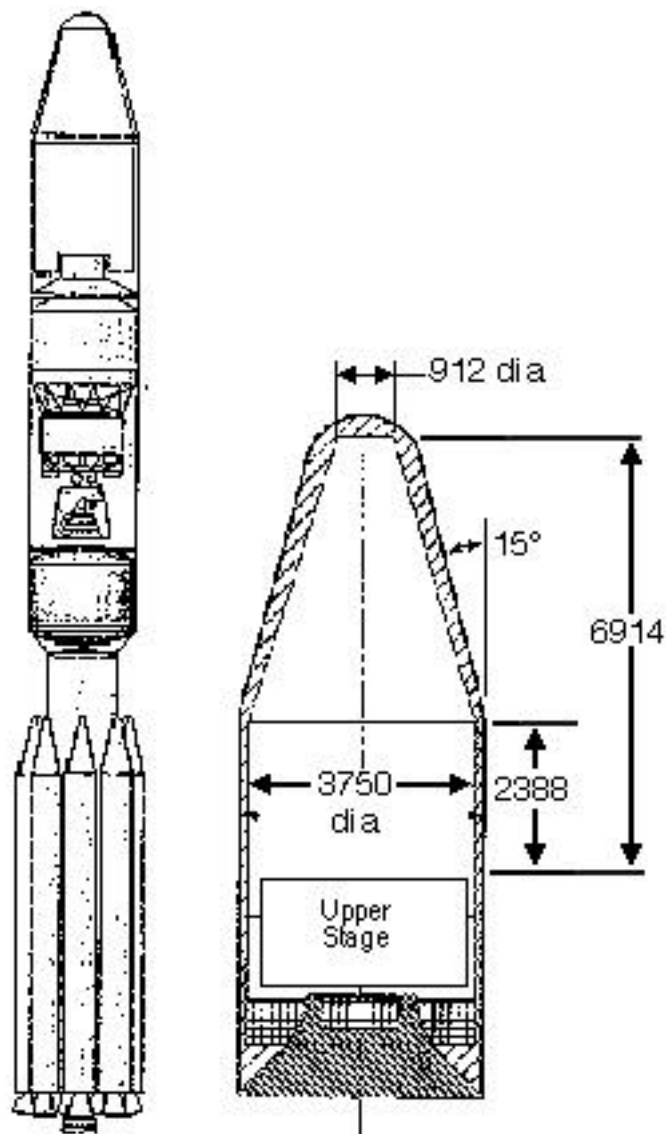
### • Launch Availability

- CCAFS: LC-17B
- VAFB being considered
- Initial Launch: May 1998 (2-stage version)
- Would likely be replaced by EELV if McDonnell Douglas/Boeing develops EELV

### • Basic Launch Service Cost

- TBD

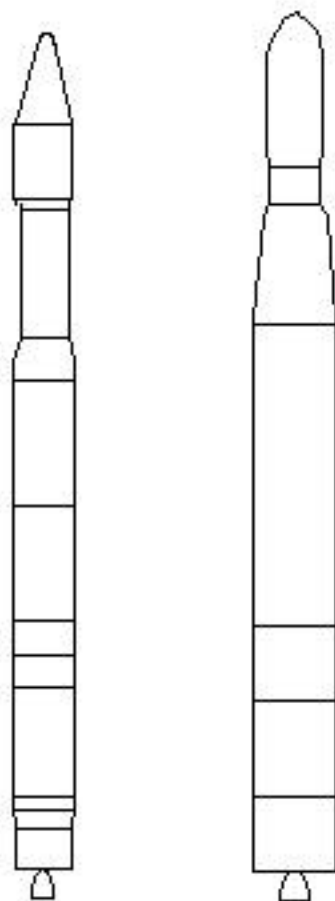
<http://www.mdc.com/version2/space/delta3.htm>



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## EELV-Small



LMA

MDA

- **Performance**

- Requirement: 1840 kg to GTO
- Estimated equivalent capabilities
  - Escape( $C3 = 0 \text{ km}^2/\text{sec}^2$ ): >1260 kg

- **Fairing/Payload Envelope**

- Delta II equivalent fairing requirement

- **Fairing Growth Plans**

- Unknown

- **Launch Availability**

- CCAFS
- First EELV Test Flight in 2001

- **Basic Launch Service Cost**

- Cost to deliver entire EELV mission model is targeted for 50% of current cost

<http://www.mdc.com/version2/space/delta4.htm>

<http://www.lmco.com/Astro/products/advancedLaunch/home.html>

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## EELV-Medium

- **Performance**

- Requirement: 3850 kg to GTO
- Estimated equivalent capabilities:
  - Escape ( $C3 = 0 \text{ km}^2/\text{sec}^2$ ): >2800 kg
  - 1 AU x 3 AU ( $C3 = 45 \text{ km}^2/\text{sec}^2$ ): >1000 kg
  - 1 AU x 5 AU ( $C3 = 77 \text{ km}^2/\text{sec}^2$ ): <300 kg

- **Fairing/Payload Envelope**

- Atlas equivalent fairing requirement

- **Fairing Growth Plans**

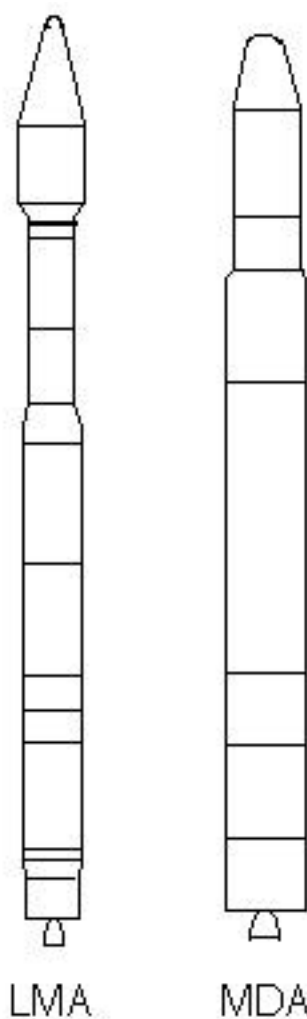
- Growth to 5 m class fairings may be considered

- **Launch Availability**

- CCAFS
- ILC: 2002

- **Basic Launch Service Cost**

- Cost to deliver entire EELV mission model is targeted for 50% of current cost



<http://www.mdc.com/version2/space/delta4.htm>  
<http://www.lmco.com/Astro/products/advancedLaunch/home.html>

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## EELV-Heavy

- **Performance**

- Requirement (T IV/SRMU goal): 6120 kg to GEO
- Estimated equivalent capabilities
  - Escape ( $C3 = 0 \text{ km}^2/\text{sec}^2$ ): >9000 kg
  - 1 AU x 3 AU ( $C3 = 45 \text{ km}^2/\text{sec}^2$ ): >4000 kg
  - 1 AU x 5 AU ( $C3 = 77 \text{ km}^2/\text{sec}^2$ ): >2000 kg

- **Fairing/Payload Envelope**

- Titan IV equivalent fairing requirement

- **Fairing Growth Plans**

- None identified

- **Launch Availability**

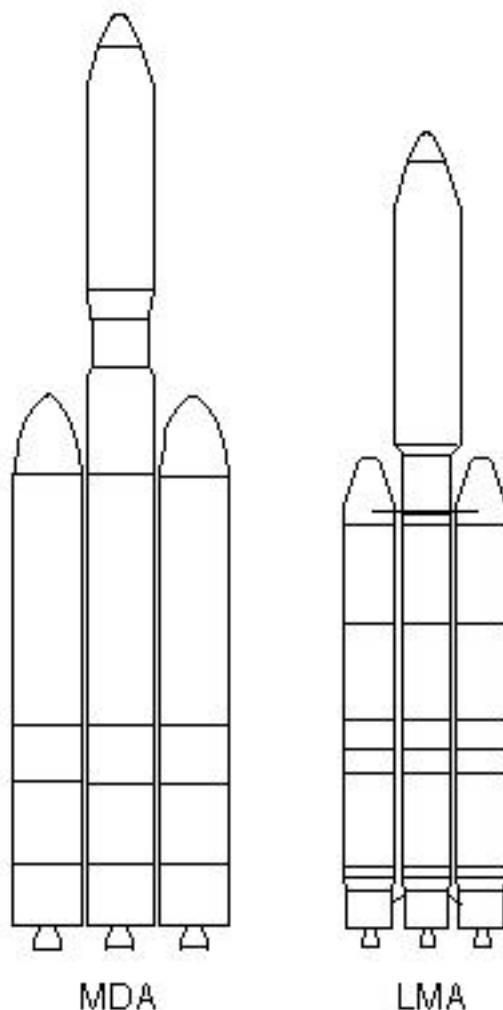
- CCAFS & VAFB
- Test Flight: 2003

- **Basic Launch Service Cost**

- Cost to deliver entire EELV mission model is targeted for 50% of current cost

<http://www.mdc.com/version2/space/delta4.htm>

<http://www.lmco.com/Astro/products/advancedLaunch/home.html>



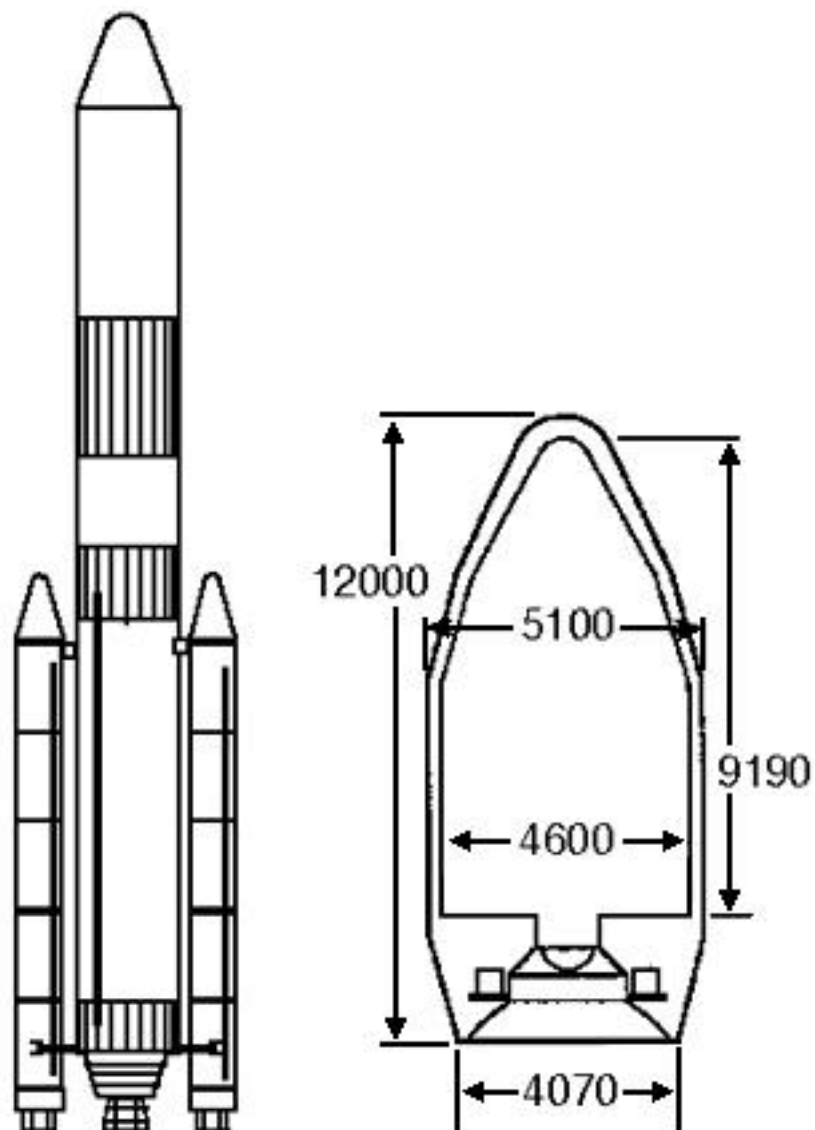
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## H-2



- **Performance**

- GTO: 4000 kg
- Escape orbit capabilities TBD

- **Fairing/Payload Envelope**

- 5.1 m composite fairing
- Envelope maximum cylindrical diameter: 4.6 m
- Envelope overall length: 9.19 m
- Envelope cylindrical section length: 4.6 m

- **Fairing Growth Plans**

- unknown

- **Launch Availability**

- Tanegashima Space Center, Yoshinobu Launch Site

- **Basic Launch Service Cost**

\$150-190M (AIAA International Reference Guide to Space Launch Systems)

[http://yyy.tksc.nasda.go.jp/Home/This/This-e/h2\\_e.html](http://yyy.tksc.nasda.go.jp/Home/This/This-e/h2_e.html)

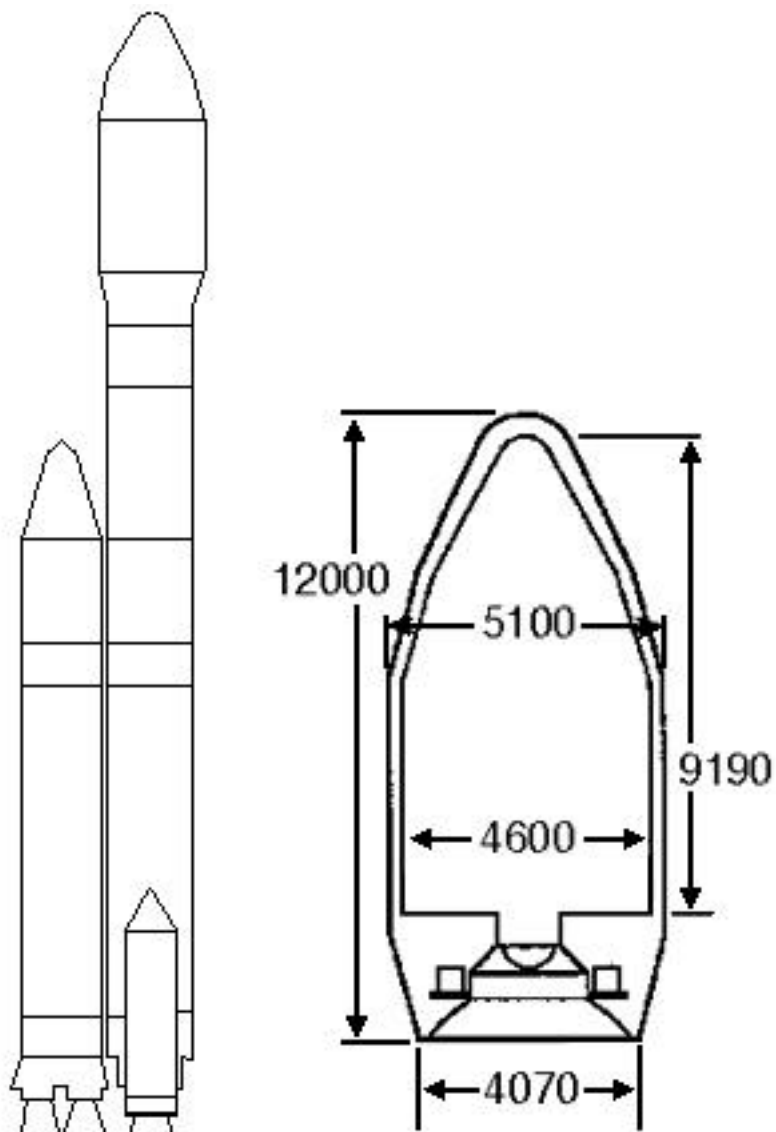
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## H-2A



- **Performance**

- GTO: 4000 - 6000 kg
- Escape orbit capabilities TBD

- **Fairing/Payload Envelope**

- 5.1 m composite fairing
- Envelope maximum cylindrical diameter: 4.6 m
- Envelope overall length: 9.2 m
- Envelope cylindrical section length: 4.6 m

- **Fairing Growth Plans**

- unknown

- **Launch Availability**

- Tanegashima Space Center, Yoshinobu Launch Site
- ILC: 2001 (heavier lift version)

- **Basic Launch Service Cost**

- \$150-190M for H-2 (AIAA International Reference Guide to Space Launch Systems)

[http://yyy.tksc.nasda.go.jp/Home/This/This-e/h2a\\_e.html](http://yyy.tksc.nasda.go.jp/Home/This/This-e/h2a_e.html)

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## Proton

### ● Performance

- Escape ( $C3 = 0 \text{ km}^2/\text{sec}^2$ ): 4800 kg
- 1 AU x 3 AU ( $C3 = 45 \text{ km}^2/\text{sec}^2$ ): 1660 kg (assuming late fairing drop)
- 1 AU x 5 AU ( $C3 = 77 \text{ km}^2/\text{sec}^2$ ): <400 kg

### ● Fairing/Payload Envelope

- 4.35 m composite fairing
- Envelope maximum cylindrical diameter: 3.88 m
- Envelope overall length: 7.3 m
- Envelope cylindrical section length: 3.5 m

### ● Fairing Growth Plans

- 5 m class fairing under development

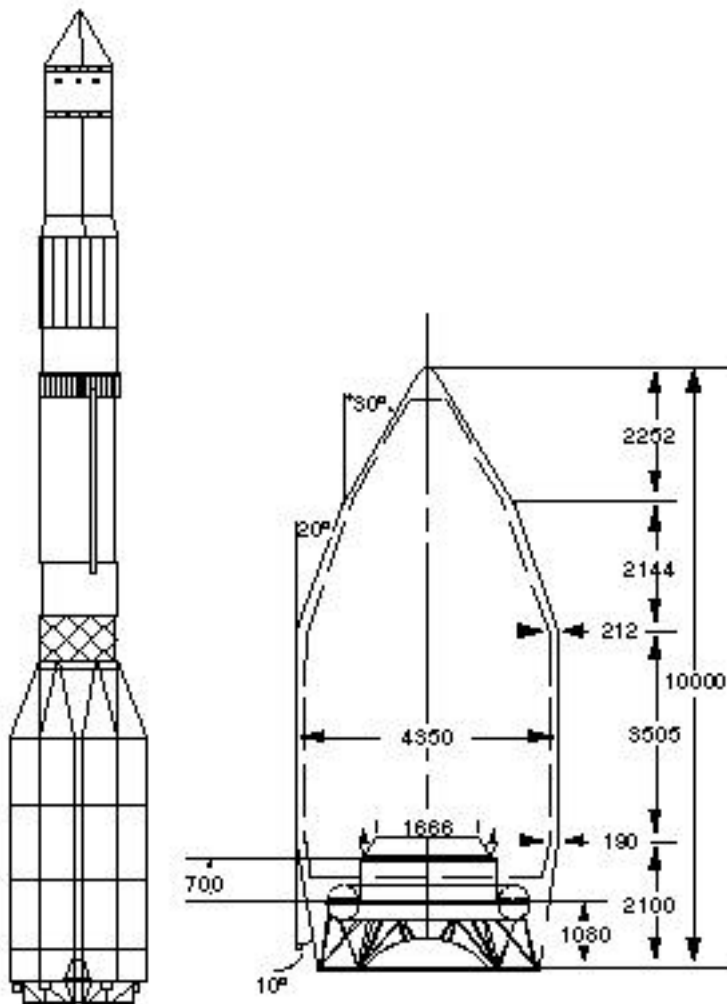
### ● Launch Availability

- Baikonur Cosmodrome: 2 pads

### ● Basic Launch Service Cost

- \$50-70M (AIAA International Reference Guide to Space Launch Systems)
- Possibility of Russia-provided launch under cooperative program

[http://www.lmco.com/ILS/txtmain/design\\_proton.htm](http://www.lmco.com/ILS/txtmain/design_proton.htm)



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## Sea Launch I/Zenit 3

- **Performance**

- Escape( $C3 = 0 \text{ km}^2/\text{sec}^2$ ): 3300 kg
- 1 AU x 3 AU ( $C3 = 45 \text{ km}^2/\text{sec}^2$ ): <300 kg

- **Fairing/Payload Envelope**

- 3.9 m composite fairing
- Envelope maximum cylindrical diameter: 3.75 m
- Envelope overall length: 8.54 m
- Envelope cylindrical section length: 4.8 m

- **Fairing Growth Plans**

- unknown

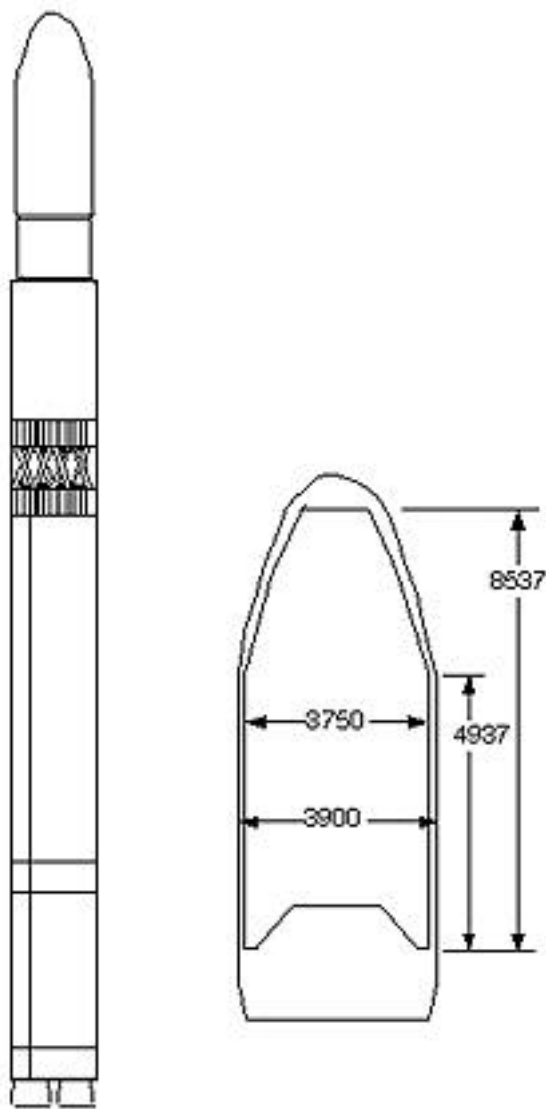
- **Launch Availability**

- Sea launch platform in Pacific Ocean
- Baikonur Cosmodrome (Ukrainian launch)
- Initial Launch: Fall 1998

- **Basic Launch Service Cost**

- \$50-70M for Zenit-3 (AIAA International Reference Guide to Space Launch Systems)
- Possibility of Ukraine/Russia-provided launch under cooperative program

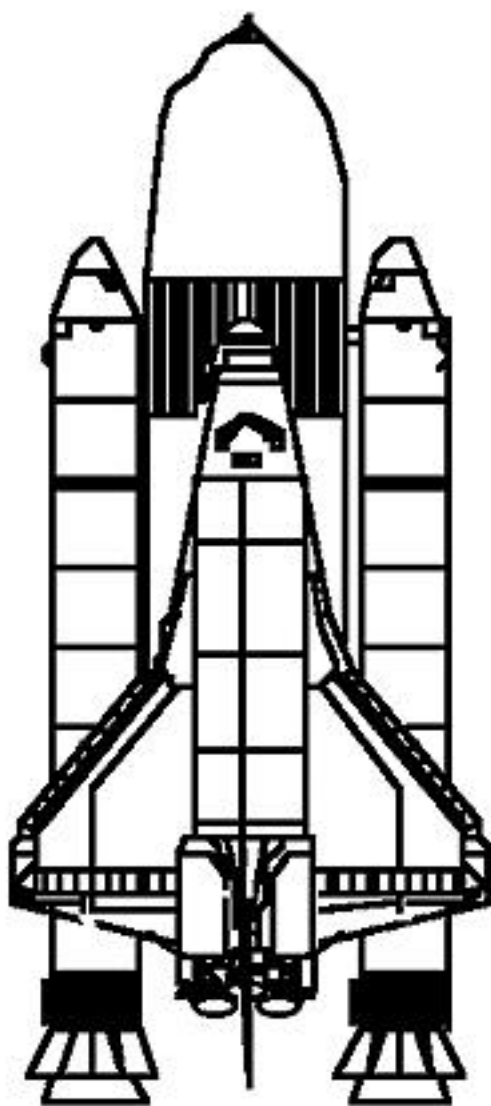
<http://www.boeing.com/sealaunch/index.html>



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# Space Transportation System



- **Performance**

- Low Earth Orbit, 28.5 degrees inclination: 24,400 kg
- International Space Station orbit: 17,100 kg
- Escape, with Inertial Upper Stage( $C3 = 0 \text{ km}^2/\text{sec}^2$ ): > 4600 kg

- **Fairing/Payload Envelope**

- 4.57 m diameter by 18.3 m length overall payload envelope
- 4.57 m diameter by 12.2 m payload envelope with IUS

- **Fairing Growth Plans**

- none

- **Launch Availability**

- Kennedy Space Center, Complex 39 A and B

- **Basic Launch Service Cost**

- \$400 - 500M

<http://TBD>

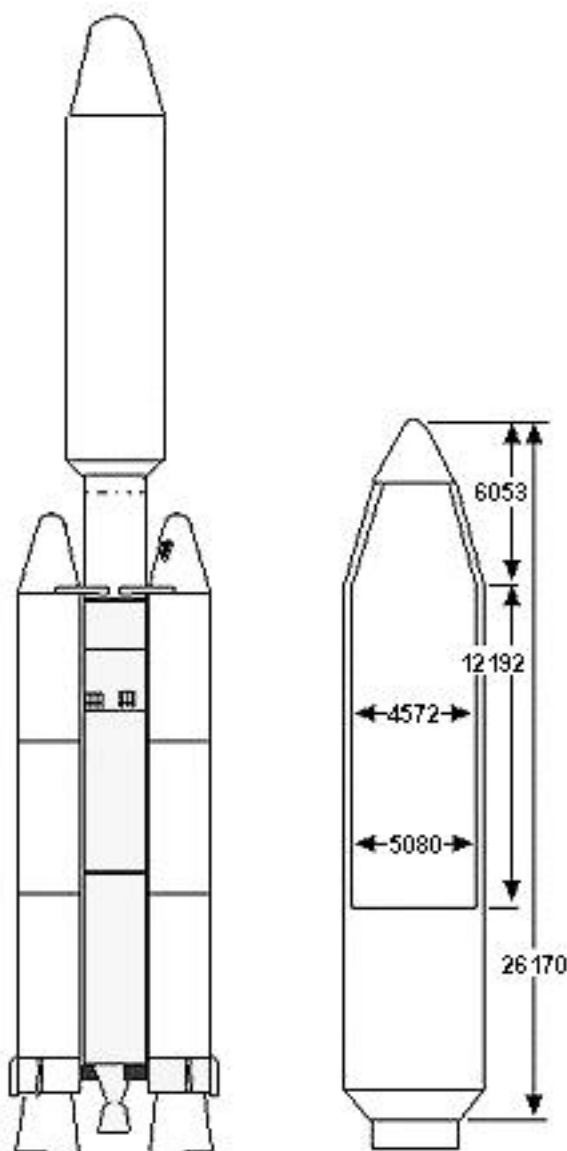
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## Titan IVB/Centaur/SRMU



- **Performance**

- Escape ( $C3 = 0 \text{ km}^2/\text{sec}^2$ ):  $\approx 8600 \text{ kg}$
- 1 AU x 3 AU ( $C3 = 45 \text{ km}^2/\text{sec}^2$ ):  $\approx 3600 \text{ kg}$
- 1 AU x 5 AU ( $C3 = 77 \text{ km}^2/\text{sec}^2$ ):  $\approx 1800 \text{ kg}$

- **Fairing/Payload Envelope**

- 5.1 m aluminum fairing
- Envelope maximum cylindrical diameter: 4.57 m
- Envelope overall length: 15.5 m
- Envelope cylindrical section length: 12.2 m

- **Fairing Growth Plans**

- None

- **Launch Availability**

- CCAS: LC 40 & 41
- To be replaced by EELV

- **Basic Launch Service Cost**

- \$250M (AIAA International Reference Guide to Space Launch Systems)

<http://www.lmco.com/Astro/products/spaceLaunch/TitanIV.html>

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